CHAPTER I

INTRODUCTION

Energy plays a vital role in human development and welfare. All modern economic activities of the present civilisation are dependent on availability and level of consumption of energy (Singh and Vimal, 1984). Energy in various forms is consumed for a wide array of needs and has become an essential ingredient of everyday life. In developed countries consumption of finite fuel resources have been increasing to maintain and raise their relative position in the world economics, whereas the developing countries, by and large, rely upon renewable sources of energy (Chand and Swarup, 1985). Of the various sectors of energy demand and consumption, the domestic sector is the major one in developing countries, accounting for 50-90 per cent of a country's energy use (Pant, 1983). From amongst 21 developing countries, sixteen that belong to the group of Least Developed Countries depend for more than three-quarters of their energy consumption on fuelwood (Montalembert and Clement, 1983).

In the rural areas of most Third World countries, women have been generally left on their own to cope with the physical and financial stress caused by the problems of energy (Patel, 1989). Women are the main participants and principal controllers in the cooking fuel cycle from procurement to end uses usually sharing or having primary responsibility for fuel gathering and in nearly all cultures, doing most of the cooking (Smith, et al, 1983 and George, 1989). It does not matter if the women are old, young or

pregnant; crucial household needs have to be met by them day after weary day (Annabel, 1991).

They spend considerable amount of time and energy in collecting fuelwood. The fuelwood collected is burnt in conventional chulhas in a highly inefficient manner, producing a lot of smoke in the cooking area leading to a variety of eye and respiratory disorders. It adversely affects not only their health but also that of infants/children who are exposed to emissions. The ill effects are compounded by the ill ventilated cooking area in a rural house. On an average, a rural woman exposes herself to smoke, equivalent of 20 packets of 20 cigarettes/day (Smith, 1981).

Massive destruction of forests and consequent ill effects on land, life and properties, and increasing difficulties of availability of fuelwood pose serious problems to the third world countries (Buenavista and Quejas, 1986 and Dayal, 1989). India derives its energy from both commercial and non-commercial energy sources. Surveys in India, on use of different energy sources, have indicated that more than 45 per cent of total energy available is consumed for cooking (Joshi, 1988; Bhide and Takwale, 1989; Karthikeyan, et al., 1989; and Mittal, 1993). About 70 per cent of India's population lives in villages depending mainly on agriculture (Alluri, 1988; Bhide and Takwale, 1989; Census Survey of India, 1991; Eighth Five Year Plan, 1992-97; Mishra, 1992; and Mittal, 1993). In the rural sector cooking of food alone consumes about 90 per cent of the available energy

and the major share comes from animal and agro-forestry (Mukherjee, 1989). Domestic sector accounts for about 13 per cent of the total energy and about 1/4 th of the total petroleum products consumed. Almost the entire quantity of non-commercial fuels is consumed by this sector (Vaidyeswaran, 1991).

The basic features of Indian Rural Energy Scene are a) low energy intensity b) high domestic energy consumption c) heavy dependence on non-commercial energy d) fuel collection through individual efforts at zero or near zero private cost, e) rapid environmental degradation and f) fuel in transition from free good to commercial commodity (Sen, et al., 1985).

Firewood continues to be a major fuel for the rural and urban areas due to its being the primary fuel since millenia and its abundant availability, infinite renewability, ecological soundness, convenience, storability and easy convertibility into useful energy (Ahsan, 1985). About 130 million tonnes of firewood is being consumed every year, of which about 105 million tonnes go for cooking alone (Karthikeyan, et al., 1989). It is estimated that about 200 million cubic meter per annum is the demand of fuelwood (Shah, 1991). Sunavala (1993) estimated that India produces annually about 600 million tonnes of agricultural wastes which include various crop residues.

Rural energy crisis has come to be identified with firewood crisis. The growing scarcity of firewood and the need for improving the quality of life calls for a fuel saving and smokeless alternative. The dwindling firewood resource, apart

from causing irreparable damage to environment, also leads to (i) longer gathering hours or increased spending on cooking fuel (ii) increased diversion of cattle dung, crop residue and even crop land for fuel purpose (Ravindranath and Shailaja, 1986). The rural population does not pay for its fuel but with increasing denudation of forests they find it difficult to get their fuelwood easily (Vaidyeswaran, 1987). Fuelwood is the fourth largest contributor to world energy supply after petroleum, coal and natural gas. With the increase in population, the requirement for fuelwood has increased faster than its rate of regeneration. As a result, deforestation and depletion of forest stock have inevitably occured (Giriappa, 1986).

India has a total forest area of about 75 million hectares which forms about 22.8 per cent of the total geographical area of the country. The average per capita forest area is around 0.12 hectares (Desai, 1991). It has been estimated that India is losing forest cover of more than 1.3 million ha every year. Mehta, et al., (1985) pointed out that deforestation is not only due to fuel needs of the village but also due to the commercial exploitation to meet the needs of urban demands for charcoal and timber. The rapid depletion of forest wood and the loss of forest area lead to serious problems of environmental degradation such as erosion, floods, siltation and desertification (Dayal, 1989). The total availability of fuelwood from regenerative capacity of (i) forests (ii) road/river sides and private lands and (iii) social forestry projects per annum is

64 million tonnes against estimated demand of 140 million tonnes (Mahajan, 1990).

With the increasing cost of fuels and difficulty in making efficient fuels available to people easily, it has now become imperative to use non-conventional sources such as solar energy and biogas, and energy efficient devices such as improved cookstoves (Kamble, 1989). Mishra (1989) emphasized the need for exploiting non-conventional sources of energy particularly those which could meet subsistence and developmental needs of the world's growing numbers. Mehta, et al., (1985) and Dayal (1989) stressed that one way of coping up with energy crisis is a simultaneous approach for reducing consumption of fuelwood and at the same time increased fuelwood production on a war footing.

National Programme on Improved Chulha (NPIC) which was conceived as National Programme on Demonstration of Improved Chulha (NPDIC) in December 1983, is an explicit expression of the strategy of Government of India to achieve the national goal of biomass conservation and to reduce drudgery in the life of an average woman. Under this programme approved models of improved chulhas are introduced through state nodal department and agency into households using biomass for cooking. Though NPIC is nearly a decade old, due to the complexity of human behaviour and due to its critical position as a vital technology and the complexities in its transfer and adoption, the programme is yet to reach a sustainable stage.

Families especially those that depend on solid biomass burning cookstoves enjoy a pivotal and critical position vis-a-vis NPIC. The success rate of NPIC and realisation of its goals depend on the extent of adoption of improved cookstoves by beneficiary families. Hence it is imperative to understand facilitators and constraints in the process of adoption of an innovative technology like Mamta Chulha which is promoted under NPIC to strengthen NPIC and to enhance rate of adoption of ICs like MC.

Improved stove like MC is innovation in the sense that it is a new technology or a new thing different from conventional or traditional cookstove. Barnett (1953) stated that an innovation as any thought, behaviour or thing that is new because it is qualitatively different from existing forms. Katz (1961) and Rogers (1962) stress on the perception of newness of anything by individual as the basis for considering any idea, product or thing as an innovation rather than its novelty in the real sense. The microdecisions families make in relation to innovations like MCs are crucial to its adoption and can be traced to its value system and goal complex. The act of developing awareness of new behaviour(s), or thing(s) that can replace existing behaviour(s) or thing(s), being convinced of its utility, its trial and mastery then freezing oneself at or accepting the new set of behaviour(s) associated with the innovation was conceptualised as adoption by Ryan and Gross (1993) who were among the first to explain the concept of adoption and others like Wilkening (1953) and Rahim (1961). Rogers (1962); Rogers and Shoemaker (1971)

have defined adoption as a mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject it. Adoption and acceptance are used as interchangeable expressions by Pedersen (1951). Unless innovations are adopted by the target group for whom it is designed, it would not lead to human wellbeing. Hence adoption of innovation is a concept of utmost significance in accomplishing the goal(s) of innovation and its transfer.

The concept of adoption is little dealt with and explored in the field of home management, though it is widely used in the field of education, agriculture and farm management. The review of literature had shown that this concept has received a little formal analysis especially with reference to renewable energy technology transfer programmes. Wilson and Gallup (1955) pointed out that adoption is a result of series of steps like attention, interest, desire, conviction, action and satisfaction. On the other hand, Bhola (1967) proposed four stages in innovation-diffusion process, namely, dissemination, demonstration, implementation and support. Singh and Pareek (1968) theorized seven steps in adoption process, viz., need, awareness, interest, deliberation, trial, evaluation and adoption. The various descriptions on adoption imply that the process of adoption occurs over a period of time. Families that are inclined to adopt a new innovation would exhibit certain behaviour acts whereby it moves from an awareness stage to an acceptance stage of the innovation in question. In the process of its existence

and survival, families adopt or accept a variety of innovations which may be in the form of ideas, behaviour processes, methods, and technologies. However, there is dearth of knowledge based on empirical information regarding the adoption of an innovation like Mamta chulha by families.

1. Statement of the Problem

The family depends on a continuous supply of energy from its environment to maintain life supporting activities which are crucial for its existence and survival. Cooking is a major energy consuming task and biomass furnishes the cooking energy needs not only of rural families but also of some urban families. The cookstoves used for burning biomass in domestic kitchens have not undergone much changes until the improved stoves with chimney were introduced in the beginning of 20th Century by organisations concerned with reducing drudgery of women. These stray efforts did not find much mass appeal. However in the context of energy crisis, it became imperative to launch energy conservation programmes on a large scale with government support. Of the various renewable energy technologies (RETs) identified to combat the increasing needs and inevitable and accelerated exhaustion of reserves of biomass and fossil fuels, improved solid biomass burning stoves promoted under National Programme of Improved Chulhas are of paramount importance in view of its closeness to conventional stoves and minimal shift required in cooking and fuel use practices on the part of its user as compared to other RETs like solar cooker.

Under NPIC, until 1988-89, emphasis was laid on improved stoves of closed type made of local materials like clayey soil, dung and ash or fine dust. During 1989-90 the development of prefab liners in pottery or ceramic and initiation of commercial ceramic units in the manufacture of prefab improved chulha components were brought into focus.

The Technical Backup Support Unit (TBSU) established under NPIC at Home Management Department which caters to the needs of NPIC in Gujarat State and Union Territories of Daman-Diu and Dadra Nagar and Haveli developed pottery/ceramic liners during 1990-91 for one of the improved cookstoves-Mamta chulha (MC)-designed by it. MC is a versatile stove appropriate to meet the cooking needs of an average family. In view of the ease in dissemination and management of MC in prefab liners without any hardware component other than chimney pipe, TBSU initiated commercial units manufacturing saggers to produce ceramic liners of MC. As a result, a commercial ceramic unit undertook the manufacture of ceramic liners for firebox, second pothole, tunnels, stove mouth shield and cowl as per design specifications furnished by TBSU at Baroda. MCs in mud are promoted since 1989-90 while MCs in prefab liners of ceramic are installed since 1991-92 in different parts of Gujarat State by Panchayat and Rural Housing Development Department, the department of Government of Gujarat and nodal agencies like Gujarat Energy Development Agency.

Under NPIC each state is assigned a target for installation of improved stoves and the progress is monitored at

village/taluka or block/district and state level by TBSUs in the respective States and by implementing bodies as well as by Regional Office of Ministry of Non Conventional Energy Sources. In addition third party assessments are also carried out. Such monitoring studies have focussed attention on physical verification and number of improved stoves in use (CTAE Annual Report, 1987; IIT Annual Report, 1988; TNAU Annual Report, 1991 and 1992; TBSU Annual Report, 1991, 1992, and 1993). It was evident from the review of literature of the last decade that various studies have been conducted with reference to energy consumption pattern in rural and urban areas and monitoring and servicing of solar cookers, improved stoves and biogas plants.

Some research questions like What are the problems families face in procuring fuel for cooking? Are families and women aware of the scarcity of cooking fuel, its available sources and their accessibility to these? Do they exercise management in cooking and fuel use? To what extent are they aware of the need to avail of Renewable Energy Technologies (RETs) like MCs? What is their level of participation in NPIC? What is the extent of adoption of MC in daily cooking and what factors account for differential levels of adoption of MC, if any, by its beneficiaries under NPIC? Can the implementation strategy of NPIC be strengthened to enhance its adoption? What are the salient features of performance of an improved chulha that appeal to its user and what features are disliked? What is the perception of users of MC regarding its appropriateness and impact on families, women and environment? Is there any association between extent of adoption

of MC and selected situational, personal and family variables of beneficiaries of NPIC? need to be answered yet. There has been very little systematic effort in this direction to study in depth adoption of ICs like MCs by beneficiaries of NPIC to capture the complexities involved in and the factors affecting the same. Probe into these research questions may help in evolving recommendations to enhance adoption rate of improved chulhas for its sustained use. It was hoped that the study would contribute to strengthen knowledge base which would prove invaluable in planning and implementing renewable energy technology intervention programmes like improved chulha programme to conserve energy while satisfying the needs of families. In this manner the output of this investigation would go a long way to combat problems of biomass scarcity and environmental degradation and improve living conditions of rural people. Moreover the insights gained with reference to facilitators and constraints in adoption of MC would prove meaningful in evolving appropriate strategies and policies in promoting not only ICs and other RETs but also improved farm implements, household technologies and the like. The database built through this study would be beneficial to policy makers and planners, implementors, extension workers, researchers and academicians. Hence an attempt was made to study adoption of MCs by its beneficiaries.

2. Objectives of the Study

i. To ascertain energy resource consumption pattern of beneficiary families of NPIC.

ii. To assess the response of beneficiary families of NPIC towards traditional rural chulha (TRC) and a selected model of improved chulha (IC), viz., Mamta chulha (MC).

iii. To measure extent of adoption of MC installed under NPIC by selected beneficiary families.

iv. To construct appropriate instruments to measure energy management practices (EMP) and main cooks' perceived levels of costs and benefits in adopting an improved chulha like MC vis-a-vis traditional chulha in daily cooking and assess energy management practices of families (EMPF) and perceived cost benefit ratio (PCBR) of main cooks.

v. To determine the inter-relationship between extent of adoption of MC and the selected situational, personal and family variables.

3. Assumptions of the Study

i. The family consumes various forms of solid biomass fuel for cooking and would be motivated to conserve biomass and ensure a cleaner environment through adoption of improved chulhas like MC.

ii. Families are unique and not alike and therefore exhibit differential levels of adoption of innovative technology like MC.

iii. The main cook can impart the relevant data on chulha and related issues as well as report on behalf of their families.

4. Hypotheses of the Study

i. There exists a relationship between extent of adoption of Mamta chulha (EAMC) and the selected situational, personal and family variables.

ii. There exists a difference in the influence exerted by the selected situational, personal, and family variables on EAMC.

5. Delimitations

The study was limited to

i. A selected model of Improved chulha, viz., Mamta chulha promoted under NPIC.

ii. 130 rural families who were beneficiary families under NPIC from each of the three selected villages, viz., Vadadla, Kanjari and Sindhrot, where State Government (SG), Non-Government Organization (NGO), and Technical Backup Support Unit (TBSU) respectively installed MCs.

iii. The following selected situational, personal and family variables.

Situational variables - level of quality of housing, extent of possession of consumer durable goods, energy base of end uses, extension of activities of family after dusk, energy management practices of family, extent of interaction of main cook and family with different spheres, extent of

participation of main cook and family in NPIC, level of quality of installation of MC, extent of demands on main cook's time and type of promoter.

Personal variables - main cook's age, education, perception regarding available and accessible cooking fuel sources, and perceived cost-benefit ratio.

Family variables - caste, size, and landholding.